

OCTOBER 17, 2016
BEAM END REPAIRS AND BEARING REPLACEMENT
FOR BRIDGES IN DISTRICT 2
FEDERAL AID PROJECT NO. 000T(002)
STATE PROJECT NO. 0172-0447
NORWICH, SPRAGUE, GRISWOLD

ADDENDUM NO. 2

SPECIAL PROVISIONS
REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- ITEM NO. 0603973A – HRCSA CORROSION PROTECTION SYSTEM
- ITEM NO. 0707009A - MEMBRANE WATERPROOFING (COLD LIQUID ELASTOMERIC)

The Bid Proposal Form and Detailed Estimate Sheets are not affected by these changes.

There will be no change in the number of calendar days due to this Addendum.

The foregoing is hereby made a part of the contract.

ITEM # 0603973A - HRCSA CORROSION PROTECTION SYSTEM

Description: Work under this item shall consist of surface preparation and field painting of the steel components of structures with an Active High-Ratio Co-Polymerized Calcium Sulfonate (HRCSA) Coating System as shown on the plans and as directed by the Engineer.

All structural steel, except those specific components listed below or on the plans, shall be abrasive blast cleaned and painted with a stripe coat (penetrant sealer) plus single top coat paint system.

Components to be painted are as shown on the plans and may include but not be limited to the following: beams and girders, diaphragms and cross frames, steel bearings, the inside surfaces of box girders, scuppers, drainage pipes and troughs, State-owned utility conduits, structural steel utility supports, non-galvanized structure mounted sign supports, steel grid decks, and all other metal components that are an integral part of the bridge system.

Privately-owned utilities, bridge rails, stay-in-place forms, fences, elastomeric bearing pads and bronze components shall be protected from damage by surface preparation and painting operations and shall not be painted.

Tabulated data for the structure(s), including the Federal Standard 595 Color Number for the top coat, are listed in tables on the plans. The estimated surface area of structural steel to be painted on each structure is given as a guide only, and is not guaranteed to be accurate. Bidders shall examine the listed structures and shall make their own determinations as to the work involved and conditions to be encountered.

Submittals: A minimum of 20 calendar days before starting any surface preparation and coating application work, the painting firm shall submit the following to the Engineer for acceptance:

1. A copy of the firm's written Quality Control Program used to control the quality of surface preparation and coating application including, but not limited to, ambient conditions, surface cleanliness and profile, coating mixing, wet and dry film thickness, and final film continuity.
2. A copy of the firm's written surface preparation and application procedures. This written program must contain a description of the equipment that will be used for removal of laminar and stratified rust, for surface preparation, including the remediation of soluble salts, and for paint mixing and application, including stripe coating (penetrant sealer). Coating repair procedures shall be included.
3. The qualifications, references and documentation of the personnel managing and performing the Quality Control Program, including a detailed description of the firm's enforcement procedures and the authority of personnel.
4. Containment plans (paint removal/collection of debris, surface preparation, coating applications with heat).
5. A proposed system / methodology for handling and disposal of the process water and solids at any and all points of its generation on the Project Site to prevent improper discharge into the surrounding environment. This submittal shall include, but not be limited to: schematic

plan(s) and written description / narrative of proposed filters, pump set-ups; a schematic and written procedure of all proposed methods to treat process water by either an onsite treatment method or an offsite disposal method.

6. If the application of heat is proposed for coating application purposes, provide information on the heat containment and procedures that will be used, with data sheets for the equipment. Note: If heat is used for coating operations, the heat and containment must be maintained to provide the required temperatures for the duration of the cure period.
7. Proof of SSPC-QP1 qualifications, CAS-certification(s) and QP2 qualifications, as applicable.
8. Coating product information, including coating manufacturer, product name, application instructions, technical data, MSDS and color chips.
9. Abrasive product information, including abrasive manufacturer, product name, technical data, and MSDS.
10. Touch-up and repair procedures, including methods and materials.
11. List of references and prior experience applying a similar HRCSA system. The list should contain at least 3 past projects.

The Contractor shall not begin any paint removal Work until the Engineer has accepted the submittals. The Contractor shall not construe Engineer acceptance of the submittals to imply approval of any particular method or sequence for conducting the Work, or for addressing health and safety concerns. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the Work in strict accordance with the requirements of Federal, State, or local regulations, this specification, or to adequately protect the health and safety of all workers involved in the Project and any members of the public who may be affected by the Project. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices, and adherence to them.

Materials: The materials for the coating system for this work shall meet the following requirements:

The Field Coating system shall be an Active High-Ratio Co-Polymerized Calcium Sulfonate (HRCSA) Coating System. The top coat must contain a minimum of 9.5% active sulfonate with the corresponding total base number at a ratio of 10 to 1 (i.e., as documented by an independent testing laboratory). The HRCSA penetrant sealer will be a minimum of 15% active sulfonate with the corresponding total base number as documented by an independent testing laboratory. The coating manufacturer must supply a minimum of a five-year material history for the specific material showing a minimum of 6,500 hours when tested under ASTM D5894 with a 24-hour freeze thaw cycle and independent test results.

The following are manufacturers of Active High-Ratio Co-Polymerized Calcium Sulfonate (HRCSA) Coating Systems. Manufacturers, other than those listed below, may be submitted for review and approval provided that their products meet the material requirements specified above.

Termarust Technologies (www.termarust.com)

- Termarust TR2200HS HRCSA (High Ratio Co-Polymerized Calcium Sulfonate) Penetrant/Sealer formulation base coat. This shall be used for the stripe coat (penetrant sealer).
- Termarust TR2100 HRCSA Primer/Top coat. The color shall be determined in the field to match the existing color of the bridge.

BIPACCO Coatings LLC

- Engineer's Choice HRCSA 10-001 Protective Sealer. This shall be used for the stripe coat (penetrant sealer).
- Engineer's Choice HRCSA 10-826 Primer/Topcoat. The color shall be determined in the field to match the existing color of the bridge

All materials for the complete coating system shall be furnished by the same coating material manufacturer with no subcontracted manufacturing allowed. Intermixing of materials within and between coating systems will not be permitted. Thinning of paint shall conform to the manufacturer's written recommendations. All components of the coating system and the mixed paint shall comply with the Emission Standards for Volatile Organic Compounds (VOC) stated in the Connecticut Department of Energy and Environmental Protection's Administration Regulation for the Abatement of Air Pollution, Section 22a-174-20(s).

After 2000 hours of accelerated weathering in accordance with ASTM D4587, the color change (ASTM D2244) shall be less than 2.0 ΔE^* with a loss of gloss (ASTM D523) less than 30. The Contractor shall provide, in their submittals to the Engineer, proof that the finish coat complies with the above criteria.

The abrasive media for blast cleaning shall be recyclable steel grit.

Control of Materials: A Materials Certificate will be required for the selected paint system in accordance with Article 1.06.07, confirming the conformance of the paint to the requirements set forth in these specifications.

Note: If any of the above or following stipulated Contract specifications differ from those of the manufacturer's recommended procedures or ranges, the more restrictive of the requirements shall be adhered to unless directed by the Engineer in writing.

Construction Methods:

Contractor - Subcontractor Qualifications:

Contractors and subcontractors doing this work are required to be certified by the SSPC Painting Contractor Certification Program (PCCP) to QP-1 entitled "Standard Procedure for Evaluating Qualifications of Painting Contractors: Field Application to Complex Structures."

When the work involves the disturbance of lead-containing paint, the Contractor and subcontractor are also required to be certified to SSPC QP-2 "Standard Procedure for Evaluating the Qualifications of Painting Contractors to Remove Hazardous Paint." The Contractor or subcontractor installing the HRCSA coating system shall have prior experience in the application of this HRCSA coating system.

Contractors and subcontractors are required to have at least one (1) **Coating Application Specialist (CAS) (SSPC ACS/NACE No. 13)**-certified (Level II-Interim Status-Minimal) craft-worker. CAS-certified (Level II-Interim Status-Minimal) craft-worker(s) are required for all crews/craft-workers up to four (4) crew members. For each crew larger than four (4), an additional CAS-certified (Level II-Interim Status-Minimal) craft-worker shall be present on each painting/blasting crew during blast cleaning and spray application (Atmospheric and Immersion Service) operations. A crew-member is a person who is on the job performing hand-held nozzle blast cleaning and/or spray application of protective coatings on a steel structure. The certification(s) must be kept current for the duration of the Project work. If a Contractor's, subcontractor's or any craft-worker's certification expires, the firm will not be allowed to do any work on this item until the certification is reissued.

Requests for extension of time for any delay to the completion of the Project due to an inactive certification will not be considered, and liquidated damages will apply. In addition, if any recoat times are exceeded, the affected areas shall be abrasive blast cleaned to SSPC-SP 10 and coatings reapplied in accordance with these specifications at no additional cost to the State. At the option of the Engineer, if such a delay will adversely impact the successful and timely completion of the Project, the Department may require the Contractor to engage another SSPC-certified firm to do the painting work at the Contractor's expense.

Quality Control Inspections: The Contractor shall perform first line, in-process Quality Control (QC) inspections. The Contractor shall implement a Quality Control Program accepted by the Engineer, including written daily reports, that ensures that the work accomplished complies with these specifications. Copies of these reports shall be provided daily to the Engineer. Contractor QC inspections shall include, but not be limited to the following:

- Suitability of protective coverings and containments
- Ambient conditions
- Surface preparation (solvent cleaning, hand/power tool or abrasive blast cleaning)
- Coating application (mixing, thinning, and wet/dry film thickness)
- Recoat times and cleanliness between coats
- Coating continuity (freedom from runs, sags, overspray, dryspray, pinholes, shadow-through, skips, misses)
- Final film acceptance

The personnel managing and performing the quality control program shall be NACE Certified Coating Inspector(s) (successfully completed Sessions I, II, III and Peer Review) or shall provide evidence of successful inspection of 3 projects of similar size and scope using HRCSA coating systems that have been completed in the last 2 years. References shall include the name, address, and telephone number of a contact person employed by the bridge owner. The

personnel performing the quality control tests shall be trained in the use of the quality control instruments. Documentation of training shall be provided. These personnel shall not perform surface preparation and painting.

Test Equipment and Materials: The Contractor shall furnish the following new test equipment and materials for use by the QC Inspector:

1. Two (2) PTC Surface Temperature Thermometers
2. Psychron 566 Psychrometer (Battery Operated) with two (2) sets of batteries or a Bacharach Sling Psychrometer
3. U.S. Weather Bureau Psychrometric Tables
4. Hypodermic Needle Pressure Gage for nozzle pressure tests.
5. SSPC Visual Standards VIS 1, VIS 3, and/or VIS 4, as applicable.
6. Testex Spring Micrometer
7. Testex Press-O-Film Replica Tape, one (1) roll, 100 pieces each, of coarse and extra-coarse per bridge span, or as specified by the Engineer.
8. Wet film thickness gage
9. PosiTest, Mikrotest or Elcometer Dry Film Thickness Gauge (FM)
10. SSPC Type 2 Dry Film Thickness Gauge per PA2
11. NIST (NBS) Calibration Standards Range: 0 – 39 mils
12. Inspection Mirror
13. Illuminated Magnifier
14. Two (2) Air Thermometer, pocket type, 30°F to 100°F

Quality Assurance Inspections: The Engineer may conduct Quality Assurance (QA) observations of any or all phases of the work. The presence or activity of Engineer inspections in no way relieves the Contractor of the responsibility to provide all necessary daily Quality Control inspections of its own and to comply with all requirements of this Specification.

The Contractor shall facilitate the Engineer's inspections as required, including allowing ample time for the inspections and providing suitable lighting (50 foot candles minimum at the surface as defined later in this specification). The Contractor shall furnish, erect and move scaffolding or other mechanical equipment to permit inspection and close observation of all surfaces to be cleaned and painted. This equipment shall be provided during all phases of the work. The Contractor shall notify the Engineer in advance of plans to remove staging used in cleaning and painting operations in order to allow for inspection. The QA inspection will be performed with the QA inspector's equipment when verifying the Contractor's test results in the field.

Safety: All Contractor activities associated with the coating work described and specified herein shall be conducted in accordance with all applicable Federal (OSHA) and State of Connecticut safety regulations, and SSPC-PA Guide 3 entitled "A Guide to Safety in Paint Application."

Ambient Conditions: Surface preparation and coating application work shall only be done inside a containment enclosure as specified herein. Surface preparation or coating work shall be

performed inside the containment enclosure meeting the following:

- The relative humidity is at or below 90%.
- The substrate is not damp, or covered by frost or ice.
- The surface temperature and air temperature are between 50° F and 100° F.
- The surface temperatures of the steel and air are more than 5° F above the dewpoint temperature, as determined by a surface temperature thermometer and electric or sling psychrometer.

If the requirements of the coating manufacturer differ from the ranges provided above, comply with the most restrictive requirements unless directed otherwise by the Engineer in writing.

Protective Coverings: The Contractor shall protect property, pedestrians, vehicular, and other traffic upon, underneath, or near the bridge, and all portions of the bridge superstructure and substructure against abrasive blast cleaning damage or disfigurement from splatters, splashes, or spray of paint or paint materials. All coating overspray, drips and spills shall be contained. Maintain the integrity and security of all protective coverings and containment materials throughout the entire Project.

Any paint chips, paint removal media (e.g., abrasives), coating or solvent that has escaped the Contractor's containment enclosure shall be cleaned up immediately. For bridges over water, the Contractor shall have on Site a sufficient quantity of spill containment boom and pads to contain a spill. The length of containment boom on Site shall be at least equal to twice the length of the active work Site over the water.

Observed Steel Defects: If significant deficiencies, such as cracks or section losses, are found during cleaning or coating operations, the Contractor shall immediately notify the Engineer as to their extent. Significant deficiencies include the following:

- a) Cracks in any part of the superstructure.
- b) Section loss more than 1/8 inch of flange thickness in a location subjected to moment and/or axial force.
- c) Section loss more than 1/8 inch of plate thickness at connection areas
Gusset plates, shim plates, base plates, bent plates etc.
- d) Section loss more than 1/8 inch of web thickness in a location subjected to shear force
- e) Section loss more than 1/8 inch of pin elements.

Heating Devices: The Contractor may use heating devices to obtain and maintain a condition within the containment enclosure that is suitable for surface preparation and painting application. For painting applications, the required conditions must be maintained for the duration of the cure period. Heating devices shall be limited to gas- or oil-fired indirect air heaters in which the

combustion products are discharged separately from the forced airstream to an area outside the containment enclosure. The heating devices must be configured so as not to form condensation on cold surfaces or cause rust-back and must be automatically controlled. Information describing the proposed heating devices and the proposed heating procedures shall be provided a minimum of 20 days in advance for Engineer acceptance.

Lighting Requirements: A minimum illumination level of 20 foot-candles shall be provided throughout the inside of the containment enclosure during surface preparation and coating application work. A minimum illumination level of 50 foot-candles shall be provided at the location of the specific work task and for inspection. All lighting fixtures and related connectors located inside the containment enclosure must be explosion proof and shall be UL listed.

Material Storage: The Contractor shall provide a suitable facility for the storage of paint that complies with all Federal and State laws and regulations.

This facility shall provide protection from the elements and ensure that the paint is stored at temperatures within the more stringent of (1) the manufacturer's written recommended temperatures, or (2) between 40° F and 100° F. If paint application takes place in conditions that require heating of the containment, then the temperature of the stored paint shall be maintained at a similar temperature. Storage of paint shall be in reasonable proximity to the painting locations. The Engineer shall be provided access to the stored paint for inspection and to witness removal of the materials. The Contractor's facility for the storage of paint shall be subject to the approval of the Engineer.

Equipment: All equipment used in surface preparation and removal of debris, such as hoses, hoppers, recycling and vacuum machines that the Contractor brings to the Site, shall be clean and free of any prior debris.

Spray equipment, brushes and rollers used in application of coatings shall be sized sufficiently and be in proper working order to accomplish the work according to the manufacturer's written recommendations.

Compressed Air: All compressed air sources shall have oil and moisture separators, attached and functional, and properly designed and sized. The compressed air sources shall deliver air to the blast nozzle, for blowing down the surfaces, or for conventional spray application that is free of oil and moisture and of sufficient pressure to accomplish the associated work efficiently and effectively. The tanks on the air compressor and moisture separator shall be drained at the end of each workday. The compressed air source shall produce a minimum pressure of 90 psi at the nozzle during abrasive blast cleaning.

The Contractor shall verify that the compressed air is free of moisture and oil contamination in accordance with the requirements of ASTM D4285. The tests shall be conducted at least once every 4 hours for each compressor system in operation. Sufficient freedom from oil and moisture is confirmed if soiling or discoloration is not visible on the paper. If air contamination is evidenced, the Contractor shall change filters, clean traps, add moisture separations or filters,

or make other adjustments as necessary to achieve clean, dry, air.

Test Sections: Prior to surface preparation, the Contractor shall prepare a test section(s) on each structure to be painted in a location(s) that the Engineer considers to be representative of the existing surface condition and steel type for the structure as a whole. The test section(s) shall be prepared using the same equipment, materials and procedures as the production operations. The Contractor shall prepare the test section(s) to the specified level according to the appropriate SSPC written specifications and visual standards. The written requirements of the specification prevail in the event of a conflict with the SSPC visual standards. Only after a test section area has been approved shall the Contractor proceed with surface preparation operations. The test section(s) shall cover approximately 10 square feet each. Additional compensation will not be allowed the Contractor for preparation of test sections.

For the production cleaning operations, the specifications and written definitions, the test section(s), and the SSPC visual standards shall be used in that order for determining compliance with the Contract requirements.

Surface Preparation:

1 – Laminar and Stratified Rust: All laminar and stratified rust or corrosion products that have formed on any area of the existing steel surfaces and accessible rust formed along edges of connected plates or shapes of structural steel shall be removed. The tools used to remove these corrosion products shall be identified in the submittals and accepted by the Engineer. If the surface preparation or removal of rust results in nicks or gouges, the work will be suspended. The Contractor shall demonstrate that the necessary adjustments have been made to prevent a reoccurrence of the damage prior to resuming work.

2 – Salt Removal and Near White Metal Blast Cleaning (SSPC-SP10): Steel surfaces shall be cleaned by the specified methods described in the SSPC Steel Structures Painting Manual, Volume 2 - Systems and Specifications, latest edition. The structural steel shall be abrasive blast cleaned according to SSPC-SP 10 “Near White Blast Cleaning.” Before and after blast cleaning, all dissolvable foreign matter, such as oil, grease, and dust shall be removed by wiping or scrubbing the surface with rags or brushes wetted with solvent in accordance with the provisions of SSPC-SP 1 “Solvent Cleaning.” Clean solvent and clean rags or brushes shall be used for the final wiping.

The entire steel structure to be coated shall be inspected to determine the degree of chemical contamination. All oil and grease shall be manually removed from the steel with proper solvent cleaning as per SSPC-SP1. Chloride and ferrous salts are expected to be present on the existing structural steel, especially where corrosion is present.

Soluble salts (chlorides, nitrates, sulfates) from the surface of the steel need to be removed prior to abrasive blast cleaning. Areas contaminated with road salts shall be cleaned with specialized chloride removal chemistry, Chlor*Rid (or Termaclean TC7101 or approved equal) before blasting. Power Washing shall be done at utilizing hot water at 7000 psi, 6 Gallons per minute, using a zero degree rotating tip and a four inch standoff. Power wash exposed surfaces as well

as crevices. Cleaning shall be done in such a manner as to not contaminate freshly painted sections. Special attention must be paid to the crevice corroded joints and connections. The connections must be flushed out during the cleaning process with the 7,000 psi 6 Gallons per minute power wash using a zero degree rotating tip and a four inch standoff.

Any excess salt level will cause paint coatings to fail. Prior to painting these surfaces, these salts must be reduced to acceptable levels as noted above. The Contractor shall verify that allowable upper limits for all residual soluble salts (chloride, nitrate and sulfate ion content) across the entire area of the bridge to painted are as noted below:

NVC3 for Chloride Ions 3 micrograms/sq.cm
 NVN10 for Nitrate Ions 10 micrograms/sq.cm
 NVS10 for Sulfate Ions 10 micrograms/sq.cm

The surface salt levels shall be determined by using a KTA SCAT Kit, Chlor-Rid Test, or approved equal. Coating shall only be done when salt testing determines that the surface salt levels are less than the upper limits specified.

All foreign materials such as dirt, dust, rust scale, sand, bird droppings, and all materials loosened by abrasive blasting operations shall be completely removed by vacuuming before any painting operations are begun. It is required that the joints and connections be blown dry with clean, dry, oil free, high pressure (100 psi) compressed air.

The cleaned surface shall be accepted by the Engineer before any painting. If the surface is determined to meet the requirements of SSPC-SP 10 and meet the thresholds for salts, painting operations can commence. The stripe coat (penetrant sealer) and top coat shall be applied to the steel before the end of the day that preparation was performed and before the formation of any flash rusting or rerusting of the steel. Flash rusting or rerusting of the surface is unacceptable and requires additional blast cleaning prior to painting.

Failure of the Contractor to prepare and clean the surfaces to be painted according to these specifications shall be cause for rejection by the Engineer. All surfaces that are rejected shall be recleaned to the satisfaction of the Engineer in accordance with these specifications, at the Contractor's expense.

3 – Steel Grit Abrasive Mix: The recyclable steel grit abrasive mix shall be maintained and monitored such that the final surface profile is within the range specified elsewhere in these specifications.

Before each reuse, the recyclable steel grit abrasive shall be cleaned of millscale, rust, paint, and other contaminants by an abrasive reclaimer.

On a weekly basis during blast cleaning operations, the Contractor shall verify that the recycled steel grit abrasives meet the requirements of SSPC-AB2. If the abrasive fails the testing, all abrasive blast cleaning operations shall be suspended. The abrasive reclaimer shall be repaired

and another abrasive sample will be required for testing after grit recovery and reclassification. For test results within the acceptable limits, abrasive blast cleaning may resume. Test results outside of the acceptable limits will require additional equipment repairs or replacement at no cost to the State. If additional repairs were performed, another sample will be required for testing after grit recovery and reclassification. If the test results continue to remain outside of the acceptable limits, the Contractor shall replace the abrasive reclaiming at no cost to the State.

4 - Surface Profile: The specified height of the steel surface profile is 1-3 mils and shall be uniform. Verification of the profile height will be done with Testex Replica Tape. A surface profile correction factor will be measured according to SSPC-PA 2, Section 2.2.4 with the dry film thickness gauge.

Note: Chemical Stripping will not be permitted.

Painting Operation:

1 - General: All coatings shall be supplied in sealed containers bearing the manufacturer's name, product designation, batch number and mixing/thinning instructions. Leaking containers shall not be used. Storage, opening, mixing, thinning and application of coating materials shall be accomplished in strict accordance with the written requirements and procedures published by the respective coating material manufacturer and supplier. In the event of a conflict, the Contractor shall notify the Engineer in writing, and unless directed otherwise in writing, the requirements of this specification shall prevail. The Contractor shall always have, at the Project Site, the current copies of all material safety data sheets (MSDS), technical data, recommendations and procedures published by the coating manufacturer for the coating materials.

2 - Paint Mixing and Thinning: Thinning shall be performed only to the extent allowed by the manufacturer's written instructions, and only with the manufacturer's approved thinner. In no case shall thinning be permitted that would cause the coating to exceed the local VOC restrictions. Thinning of the Penetrant Sealer for Stripe Coat will not be allowed. For multiple component paints, only complete kits shall be mixed and used. Partial mixing is not allowed.

The ingredients in the containers of paint shall be thoroughly mixed by mechanical power mixers in the original containers, or as directed by the manufacturer, before use or mixing with other containers of paint. The paint shall be mixed in a manner that will break up all lumps, completely disperse pigment and result in a uniform composition. Paint shall be carefully examined after mixing for uniformity and to verify that no unmixed pigment remains on the bottom of the container. Excessive skinning or partial hardening due to improper or prolonged storage will be cause for rejection of the paint, even though it may have been previously inspected and accepted.

Multiple component coatings shall be discarded after the expiration of the pot life. Single component paint shall not remain in spray pots, painter's buckets, or similar containers overnight. It shall be stored in a covered container and remixed before use.

The Engineer reserves the right to sample field paint (individual components or the mixed material) and have it analyzed. If the paint does not meet the product requirements due to excessive thinning or because of other field problems, the coating shall be removed from that section of the structure and replaced as directed by the Engineer.

3 - Methods of Application: All applicators of the specified coating material shall show proficiency on a test panel, or a portion of the structure as selected by the Engineer, to the satisfaction of the Engineer before commencing full-scale application.

The preferred method for coating application shall be by airless spray equipment. For stripping and for application in areas where complex shapes or tight clearances will not allow spray application, the Contractor shall apply the coating material by appropriately designed and constructed rollers and brushes.

4 - Recoat Times: The recoat time of the top coat after application of the stripe coat (penetrant sealer) shall not deviate from the written recommendation of the manufacturer or the times specified in these specifications, complying with the most restrictive requirements unless directed otherwise by the Engineer in writing. If any individual time is exceeded, the affected areas shall be abrasive blast cleaned to SSPC-SP 10 and coatings reapplied in accordance with these specifications at no additional cost to the State.

5 - Film Continuity: All applied coatings shall exhibit no running, streaking, sagging, wrinkling, holidays, pinholes, top coat color or gloss variation, or other film defects. Failure of the Contractor to apply coatings that are free of film defects shall be cause for rejection by the Engineer. All coatings rejected shall be repaired to the satisfaction of the Engineer, at the Contractor's expense. Before doing any coating repair work, the Contractor shall submit to the Engineer for approval the procedures that will be used to repair the coating.

6 - Technical Advisor: It is mandatory that the Contractor obtain the services of a qualified technical advisor employed by the coating manufacturer. This advisor shall be familiar with the technical properties of the coating products and proper application methods. The technical advisor shall assist the Engineer and the Contractor in establishing correct application methods for the complete coating system. He/she shall be present at the work Site before the opening of the material containers and shall remain at the Site until the Engineer is satisfied that the Contractor's personnel have mastered the proper handling, mixing and application of the material. The Engineer may call the technical advisor back to the Site if there are concerns that the Contractor is not handling, mixing or applying the material correctly.

7 - Containment Plan: For each individual Site, the Contractor shall submit a plan of containment to the Engineer for acceptance. The plan, as outlined in other Contract item special provisions, shall be submitted 20 days before commencing painting operations. The stripe coat

(penetrant sealer) and topcoat shall be applied within the same containment used for abrasive blast cleaning. In addition to meeting all the requirements of containment for abrasive blast cleaning as outlined in other Contract Special Provisions, the containment shall also be capable of containing water during power washing. The additional cost of containment of water is included under this item.

8 - Stripe Coat (Penetrant Sealer) Application: All prepared surfaces shall be cleaned by vacuuming to remove dust, remaining debris, and other surface contaminants before coating. Such surfaces shall then be sprayed, brushed or rolled within the specified abrasive blast cleaning containment enclosure with the stripe coat (penetrant sealer) and the top coat before the end of the day or before any visible rust-back occurs. If rust-back occurs, affected surfaces shall be recleaned to the satisfaction of the Engineer in accordance with these specifications, at no additional cost to the State.

The penetrant sealer may be applied by brush, aerosol, hand pump, airless, air assisted airless, High Volume Low Pressure (HVLP), Low Volume Low Pressure (LVLP) or conventional air atomize spray equipment. The penetrant sealer shall be mixed thoroughly by hand to ensure homogeneity. Screen the coating before applying to remove solid particulates.

Deposit enough coating to thoroughly wet the joint seams. Coat the upper edge of all seams first, working down the sides of the joint from top to bottom thoroughly wetting the seam with coating to push the material into the joint. Moisture will be displaced from the joint and shall be allowed to exit freely from the bottom of the jointed area. (Note: Joint geometries vary widely. It is not the intent of this specification to address application to each joint type. The applicator must evaluate individual joint geometries to determine the application method which will result in optimal joint penetration coverage). Because of the porous nature of the rust layer and the inaccessibility of the area inside the joint, wet film thickness measurements will not be taken.

Penetrant/Sealer shall be applied to thoroughly wet all joints and connections, including around bolts, nuts and rivets where gaps exist. All stripe coating shall be applied by spray, but immediately afterwards it must be 'brushed-in' using a brush. Allow excess coating and moisture to exit from the lower edge of the treated joints. If the coating runs or sags, smooth it out with a brush. Any excessive surplus of Penetrant/Sealer shall be brushed out from adjacent or other surfaces to not inhibit the drying of the top coat to be applied in the following step. No other method of coating application will be allowed for stripe coating.

This low viscosity, penetrating coating is intended for use as a penetrant for jointed or bolted areas, corrosion frozen bearings of steel structures which suffer from pack-out rusting or as an anti-corrosive treatment for steel surfaces that are in contact. All crevices on the structure shall receive a stripe coat (penetrant sealer). Crevices are defined as any location where there is contact between two plates/surfaces where infiltration of water has created or has the potential to create pack rust. The "crevice" applies to all contact surfaces on and between all steel components of the bridge being coated. When steel repairs are performed, the surfaces in contact (new steel contacting existing steel) shall be surface prepared as required by these specifications and shall have the penetrant sealer applied prior to bolting.

As soon as the stripe coat has been applied, the top coat may be applied.

The stripe coat (penetrant sealer) primer shall be applied to dry surfaces within the more restrictive temperature range (both steel and air) as specified in the manufacturer's written application instructions or between 50°F and 100°F, unless directed otherwise by the Engineer in writing. No Coatings shall be applied unless the steel surface temperature is 5°F above the dew point.

9 - Top Coat Application: When the stripe coat (penetrant sealer) has been applied per the manufacturer's written recommendations, all previously prepared surfaces shall receive the top coat. The steel surface shall be clean and free of all surface and embedded contamination and dry-spray. If it is not clean and free of all contamination, the surfaces shall be prepared again in accordance with these specifications. Temperature ranges (both steel and air) shall be the more restrictive of that specified in the manufacturer's written application instructions or between 50°F and 100°F, unless directed otherwise by the Engineer in writing.

The top coat shall be applied to prepared steel at 15-18 mils wet, 10-12 mils dry film thickness. There shall be no areas of steel that receive less than 15 mils wet coverage. Extreme care shall be taken to thoroughly coat all joints, flange edges, sharp angles, rivets, bolt heads, nuts, threads and flange bottoms. Wet film thickness shall be confirmed by the Contractor at regular and frequent intervals. Wet film thickness over the specified level to a maximum of 25 mils wet will be acceptable; however, film thickness below 15 mils wet will be rejected. All pack rusted joints must be treated with HRCSA Penetrant/Sealer. An additional caulk coat of 15 to 18 wet mils of Primer/Top coat shall be applied to the joints treated with the HRCSA Penetrant/Sealer.

Because of the slow cure of active calcium sulfonate coatings, wet film measurements shall be used as criteria for preliminary acceptance of the coating. WFT measurements shall be determined as the job progresses and corrections shall be made during coating application. Areas failing to meet the specified wet film thickness (WFT) range shall be over-coated with the same coating to produce at least the total WFT required. Coating applied containing unauthorized thinners, coating applied to contaminated surfaces, and coating applied contrary to this Specification shall result in the re-cleaning and re-coating of the surface. The work of re-cleaning, re-coating or over-coating, if required, shall be performed within 10 days following notification by the Engineer and shall be done by the Contractor, at its expense, to the satisfaction of the Engineer.

Dry film thicknesses shall be determined using SSPC-PA2 using a digital film thickness gage and a shim after the coating has cured sufficiently to allow accurate measurements. Note: Depending upon ambient air conditions, it may take more than one week before DFT measurements can be taken.

10 - Process Water Handling and Disposal: The Contractor shall furnish, install and operate a coordinated system that provides for the handling and disposal of any water and solids from their activities. This system shall be of adequate size and design to handle said water and any loose paint, loose rust and salts.

The Contractor shall procure all equipment to temporarily contain and/or store all process water as well as all sediment and other solids as necessary prior to on-Site treatment or transportation to an off-Site treatment facility. Said equipment shall be in good working order, leak free and be fully decontaminated both prior to delivery for use on this Project and upon completion of the Project.

Treatment of process water shall be by either an on-Site treatment method or off-Site disposal method. Method must adhere to and meet any and all local, State and Federal requirements. All surplus processed water must be tested per DEEP regulation prior to disposal. If found to contain contamination at a level higher than the allowable discharge limit, the process water must be treated or transported to a permitted facility for proper disposal.

11 - Date of Completion: The word “PAINTED” followed by the month and year the painting of each structure was completed, along with the manufacturer’s abbreviations the stripe coat as well as top coat shall be stenciled on the inside face (non-fascia side) of the bearing in three (3) inch high block letters. In order to ensure uniformity, abbreviations shall be approved by the Engineer prior to application of the stenciled information.

Method of Measurement: This item, being paid for on a lump sum basis for each site number, will not be measured for payment.

Basis of Payment: This work will be paid for at the Contract lump sum price for “HRCSA Corrosion Protection System” which price shall include all materials, equipment, painting overspray containment enclosure, modifications to containment systems to include containment of water during power washing operations, heating devices, tools, labor, and services of the technical advisor. No direct payment will be made for the cost of storage or hauling the paint and other materials to and from the bridge site(s), but the cost thereof shall be included in the lump sum price as noted above.

Pay Item	Pay Unit
HRCSA Corrosion Protection System	l.s.

ITEM #0707009A – MEMBRANE WATERPROOFING (COLD LIQUID ELASTOMERIC)

Description: Work under this item consists of furnishing and installing a seamless elastomeric waterproofing membrane system applied to a concrete or steel surface as shown on the plans, in accordance with this specification and as directed by the Engineer. Work shall also include conditioning of the surface to be coated and all quality-control testing noted herein.

The completed membrane system shall be comprised of a primer coat followed by the membrane coating which is applied in one or two layers for a minimum total thickness of 80 mil (2 mm), an additional 40 mil (1mm) membrane layer with aggregate broadcast into the material while still wet, and a bond coat of bitumen-based adhesive material.

Materials: The Contractor shall select a waterproofing membrane system from the Department's current Qualified Product List (QPL) for Spray-Applied Membrane Waterproofing System. All materials incorporated in the works shall meet the Manufacturer's specification for the chosen system. The Engineer will reject any system that is not on the QPL.

Materials Certificate: The Contractor shall submit to the Engineer a Materials Certificate for the primer and membrane and bond coat material in accordance with the requirements of Article 1.06.07.

Construction Methods: At least ten days prior to installation of the membrane system, the Contractor shall submit to the Engineer, the manufacturer's recommended procedure for preparing the deck surface, pre-treatment or preparing at cracks and gaps, treatment at curbs, vertical surfaces or discontinuities, applying the primer and membrane, and placing of aggregated coat. Procedures shall also include recommended repairs of system non-compliant issues identified during application. The system shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.

A technical representative, in the direct employ of the manufacturer, shall be present on-site immediately prior to and during application of the membrane. The representative shall inspect and approve the surface prior to priming, and provide guidance on the handling, mixing and addition of components and observe application of the primer and membrane. The representative shall perform all required quality-control testing and remain on the Project site until the membrane has fully cured.

All quality-control testing, including verbal direction or observations on the day of the installation, shall be recorded and submitted to the Engineer for inclusion in the Project's records. A submittal of the quality-control testing data shall be received by project personnel prior to any paving over the finished membrane or within 24 hours following completion of any staged portion of the work.

1. **Applicator Approval:** The Contractor's membrane Applicator shall be fully trained and licensed by the membrane manufacturer and shall have successfully completed at least three spray membrane projects in the past five years. The Contractor shall furnish references from those projects, including names of contact persons and the names, addresses and phone numbers of persons who supervised the projects. This information shall be submitted to the Engineer prior to the start of construction. The Engineer shall have sole authority to determine the adequacy and compliance of the submitted information. Inadequate proof of ability to perform the work will be grounds to reject proposed applicators.

2. **Job Conditions:**

- (a) **Environmental Requirements:** Air and substrate temperatures shall be between 32°F (0°C) and 104°F (40°C) providing the substrate is above the dew point. Outside of this range, the Manufacturer shall be consulted.

The Applicator shall be provided with adequate disposal facilities for non hazardous waste generated during installation of the membrane system. The applicator shall follow safety instructions regarding respirators and safety equipment.

- (b) **Safety Requirements:** All open flames and spark producing equipment shall be removed from the work area prior to commencement of application.

"No Smoking" signs shall be visibly posted at the job site during application of the membrane waterproofing.

Personnel not involved in membrane application shall be kept out of the work area.

3. **Delivery, Storage and Handling:**

- (a) **Packaging and Shipping:** All components of the membrane system shall be delivered to the site in the Manufacturer's packaging, clearly identified with the products type and batch number.
 - (b) **Storage and Protection:** The Applicator shall be provided with a storage area for all components. The area shall be cool, dry and out of direct sunlight and shall be in accordance with the Manufacturer's recommendations and relevant health and safety regulations.

Copies of Material Safety Data Sheets (MSDS) for all components shall be kept on site for review by the Engineer or other personnel.

- (c) **Shelf Life - Membrane Components:** Packaging of all membrane components shall include a shelf life date sealed by the Manufacturer. No membrane components whose shelf life has expired shall be used.

4. Surface Preparation:

- (a) Protection: The Applicator shall be responsible for the protection of equipment and adjacent areas from over spray or other contamination. Parapets and bridge joints shall be masked prior to application of the materials.
- (b) Surface Preparation: Sharp peaks and discontinuities shall be ground smooth. The surface profile of the prepared substrate is not to exceed 1/4 inch (6 mm) (peak to valley) and areas of minor surface deterioration of 1/2 inch (13 mm) and greater in depth shall also be repaired. The extent and location of the surface patches require the approval of the Engineer before the membrane system is applied.

Surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae, growth, laitance, friable matter, dirt, bituminous products, and previous waterproofing materials. If required, degreasing shall be done by detergent washing in accordance with ASTM D4258.

The surface shall be abrasively cleaned, in accordance with ASTM D4259, to provide a sound substrate free from laitance.

Voids, honeycombed areas, and blow holes on vertical surfaces shall be repaired in the same manner.

All steel components to receive membrane waterproofing shall be blast cleaned in accordance with SSPC SP6 and coated with the membrane waterproofing system within the same work shift.

5. Inspection and Testing: Prior to priming of the surface, the Engineer, Applicator and Manufacturer's technical representative shall inspect and approve the prepared substrate.

- (a) Random tests for deck moisture content shall be conducted on the substrate by the Applicator at the job site using a "Sovereign Portable Electronic Moisture Master Meter," a "Tramex CMEXpertII Concrete Moisture Meter" or approved equal. The minimum frequency shall be one test per 1000 s.f. (100 sq.m) but not less than three tests per day per bridge. Additional tests may be required if atmospheric conditions change and retest of the substrate moisture content is warranted.

The membrane system shall not be installed on substrate with a moisture content greater than that recommended by the system's manufacturer, but shall not be greater than 6%, whichever is less.

- (b) Random tests for adequate tensile bond strength shall be conducted on the substrate using an adhesion tester in accordance with the requirements of ASTM D4541. The

minimum frequency shall be one test per 5,000 s.f. (500 sq.m) but not less than three adhesion tests per bridge.

Adequate surface preparation will be indicated by tensile bond strengths of primer to the substrate greater than or equal to 150 psi (1.0 MPa) or failure in a concrete surface and greater than or equal to 300 psi (2.1 MPa) for steel surfaces.

If the tensile bond strength is lower than the minimum specified, the Engineer may request additional substrate preparation. Any primer not adequately applied shall be removed and a new primer applied at the Contractor's expense, as directed by Engineer.

- (c) Cracks and grouted joints shall be treated in accordance with the Manufacturer's recommendations, as approved or directed by the Engineer.

6. Application:

- (a) The System shall be applied in four distinct steps as follows:
 - 1) Substrate preparation and gap/joint bridging preparation
 - 2) Priming
 - 3) Membrane application
 - 4) Membrane with aggregate
- (b) Immediately prior to the application of any components of the System, the surface shall be dry (see Section 5a of this specification) and any remaining dust or loose particles shall be removed using clean, dry oil-free compressed air or industrial vacuum.
- (c) Where the area to be treated is bound by a vertical surface (e.g. curb or wall), the membrane system may be continued up the vertical, as shown on the plans or as directed by the Engineer.
- (d) The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results, in accordance with the Manufacturer's recommendations or as approved or directed by the Engineer.
- (e) A neat finish with well defined boundaries and straight edges shall be provided by the Applicator.
- (f) Primer: The primer shall consist of one coat with an overall coverage rate of 125 to 175 s.f./gal (3.0 to 4.3sq.m/1) unless otherwise recommended in the manufacturer's written instructions.

All components shall be measured and mixed in accordance with the Manufacturer's recommendations.

The primer shall be spray applied using a single component spray system approved for use by the Manufacturer. If required by site conditions and allowed by the manufacturer, brush or roller application will be allowed.

The primer shall be allowed to cure tack-free for a minimum of 30 minutes or as required by the Manufacturer's instructions, whichever time is greater, prior to application of the first lift of waterproofing membrane.

Porous concrete (brick) may require a second coat of primer should the first coat be absorbed.

- (g) Membrane: The waterproofing membrane shall consist of one or two coats for a total dry film thickness of 80 mils (2 mm). If applied in two coats, the second coat shall be of a contrasting color to aid in quality assurance and inspection.

The membrane shall be comprised of Components A and B and a hardener powder which is to be added to Component B in accordance with the Manufacturer's recommendations.

The substrate shall be coated in a methodical manner.

Thickness checks: For each layer, checks for wet film thickness using a gauge pin or standard comb-type thickness gauge shall be carried out typically once every 100 s.f. (9 sq.m). Where rapid set time of the membrane does not allow for wet film thickness checks, ultrasonic testing (steel surfaces only), calibrated point-penetrating (destructive) testing, in-situ sampling (cutout of small sections for measuring thicknesses), or other methods approved by the Engineer shall be employed for determination of dry film thickness. The measured thickness of each and every individual test of the membrane shall be greater than or equal to the required thickness.

Bond Strength: Random tests for adequate tensile bond strength shall be conducted on the membrane in accordance with the requirements of ASTM D4541. The minimum test frequency shall be one test per 5,000 s.f. (500 sq.m) but no less than three adhesion tests per bridge. Adequate adhesion will be indicated by tensile bond strengths of the membrane to the substrate of greater than or equal to 150 psi (0.7 MPa) or failure in a concrete surface and greater than or equal to 300 psi (2.1 MPa) for steel surfaces.

Spark Testing: Following application of the membrane, test for pin holes in the cured membrane system over the entire application area in accordance with ASTM D4787- "Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates." Conduct the test at voltages recommended by the manufacturer to prevent damage to the membrane.

Repair the membrane system following destructive testing and correct any deficiencies in the membrane system or substrate noted during quality-control testing in accordance with the manufacturer's recommendations to the satisfaction of the Engineer at no additional cost to the State.

- (h) Repairs: If an area is left untreated or the membrane becomes damaged, a patch repair shall be carried out to restore the integrity of the system. The damaged areas shall be cut back to sound materials and wiped with solvent (e.g. acetone) up to a width of at least four inches (100 mm) on the periphery, removing any contaminants unless otherwise recommended by the manufacturer. The substrate shall be primed as necessary, followed by the membrane. A continuous layer shall be obtained over the substrate with a four inches (100 mm) overlap onto existing membrane.

Where the membrane is to be joined to existing cured material, the new application shall overlap the existing by at least four inches (100 mm). Cleaning and surface preparation on areas to be lapped shall be as recommended in the manufacturer's written instructions.

- (i) Aggregated Finish:
 - 1) Apply an additional 40 mil (1 mm) thick layer of the membrane material immediately followed by an aggregate coating, before the membrane cures, at a rate to fully cover the exposed area. The membrane and aggregate shall be fully integrated after the aggregate has been applied and the membrane cured.
 - 2) Localized areas not fully coated shall be touched-up with additional membrane and aggregate as needed.
 - 3) Remove loose and excess aggregate from the surface to the satisfaction of the Engineer and dispose of properly after application prior to allowing traffic onto finished surface or application of tack coat.
- (j) Bond Coat:
Prior to application of a bituminous concrete overlay, the aggregated finish shall be coated with a bonding material. The bonding material shall be per the membrane waterproofing manufacturer's recommendations.

7. Final Review: The Engineer and the Applicator shall jointly review the area(s) over which the completed System has been installed. Any irregularities or other items that do not meet the requirements of the Engineer shall be addressed at this time.

Method of Measurement: The quantity to be paid for under this item shall be the number of square yards (square meters) of waterproofed surface completed and accepted.

Basis of Payment: This item will be paid for at the contract unit price per square yard (square meter) of “Membrane Waterproofing (Cold Liquid Elastomeric),” complete in place, which price shall include all surface preparation, furnishing, storing and applying the system, technical representative and quality control tests, and any necessary repairs and remediation work as well as all materials, equipment, tools, labor incidental to this work.

<u>Pay Item</u>	<u>Pay Unit</u>
Membrane Waterproofing (Cold Liquid Elastomeric)	s.y. (sq.m)